Angular intra prediction and ADI simplification (JCTVC-B118)

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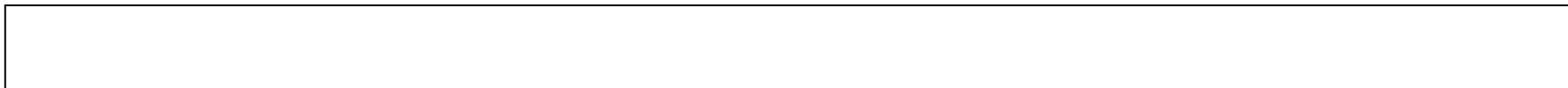
Overview

- TMuC defines two types of Intra prediction mechanisms
  - Angular intra prediction and ADI
  - Tool usage depends on block size:
    - For blocks of size 64x64 : 33 Directions (ADI+Planar)
    - For blocks of size 32x32 : 33 Directions (ADI+Planar)
    - For blocks of size 16x16 : 33 Directions (ADI+Planar)
    - For blocks of size 8x8 : 33 directions (Angular+Planar)
    - For blocks of size 4x4: 9 directions (AVC)

Motivation

- Accessing side reference requires y-intercept calculation and hence division by slope

Direction = horizontal 4

Direction = horizontal -3

Direction = vertical 2
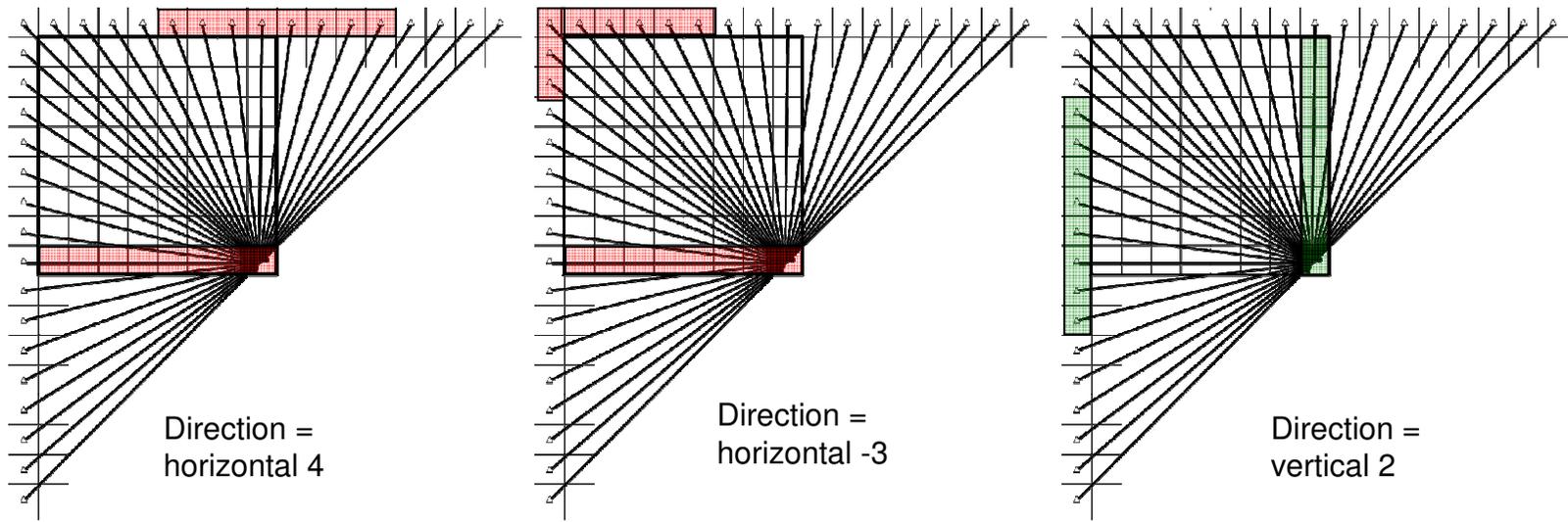
- Equations:

```
deltaIntSide   = (8*8*(l+1)/absAng) >> 3;
deltaFractSide = (8*8*(l+1)/absAng) % 8;
```

- Exact divisions costly to implement in software and hardware

Simple optimization

- Original equations:

```
deltaIntSide   = (8*8*(l+1)/absAng) >> 3;
deltaFractSide = (8*8*(l+1)/absAng) % 8;
```

- Replace division with multiplication by reciprocals
  - ```deltaIntSide   = (absAngInvTable[absAng]*(l+1)) >> 3;```
  - ```deltaFractSide = (absAngInvTable[absAng]*(l+1)) % 8;```
  - ```where absAngInvTable = [64, 32, 21, 16, 12, 10, 9, 8];```

- Since equation is linear in *l* now, only additions required

- If multiplication with absAngInvTable[] is required, then the multiplication factors are very simple requiring two additions is most cases (but for value of 21)

BD-Rate increase

- No coding loss

- Above optimization was integrated into TMuC-04-bugfix. A total of 20 frames were encoded using the scripts in cfg\cfp-fast and Alpha.bat with –ip 1 (All Intra coding).

Fast angular prediction

		BD-Rate increase
S01	Traffic	-0.01
S02	PeopleOnStreet	-0.01
S03	Kimono	-0.03
S04	ParkScene	-0.02
S05	Cactus	0.01
S06	BasketballDrive	-0.04
S07	BQTerrace	0.00
S08	BasketballDrill	0.00
S09	BQMall	-0.01
S10	PartyScene	-0.04
S11	RaceHorses	-0.08
S12	BasketballPass	0.05
S13	BQSquare	0.01
S14	BlowingBubbles	0.05
S15	RaceHorses	-0.02
All Seq Avg		**-0.01**
All Seq Min		**-0.08**
All Seq Max		**0.05**

Conclusions

- Division replaced by a few additions

- No coding loss because of optimization

- Remove division in angular prediction and ADI equations in TMuC